DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with the present invention, methods are disclosed for constructing new forms of roll functions that can be used in the KS_Method for constructing track and guide way curve transition shapes. With these new forms of roll functions the KS_Method can create spirals that are more flexible than the spiral shapes available heretofore, and it can also create transition shapes referred to as bends, jogs, and wiggles that have characteristics different from spirals and one from another, as previously described. Further, in accordance with the present invention, the "small angle" simplification method is disclosed for designing bends, jogs, and wiggles.

In a first aspect of the present invention, for defining a set of basic roll functions, a basic roll function of integer order n is defined in terms of its second derivative with respect to distance along the shape by requiring the latter to be of the form

$$k_n\,(a^2 - s^2)^{(m)}\, C_n^{(m+½)}(s/a), \quad n > 0 \qquad (2)$$

where $C_n^{a}(x)$ is the standard Gegenbauer orthogonal polynomial as defined in standard references (such as Abramowitz & Stegun, "Handbook of Mathematical Functions", US Government Printing office, Washington, DC, 1964, chapter 22), k_n is an adjustable constant, a is one half the length of the transition shape, s is distance along the shape relative to the midpoint thereof, and m is a not necessarily integer value ≥ 1. The value for m that is expected to be most useful is $m = 2$. However, values such as $m = 1.5$, 2.5, and 3 could also give usable shapes. It is not necessary that m be half integral, but when it is not $C_n^{(m+1/2)}(s/a)$ will include non integral powers of x so that algebra will be more complex.

The expressions for roll angle versus distance obtained by integrating equation (2) two times with respect to s takes the form

$$j_1 \text{ (integral on } t \text{ from } -a \text{ to } s \text{ of } (a^2 - t^2)^{(m+2)}) \qquad (3)$$

when $n = 1$, and the form

$$j_n\,(a^2 - s^2)^{(m+2)}\, C_{n-2}^{(m+5/2)}(s/a), \quad n > 1 \qquad (4)$$

when $n > 1$, where j_n is a new constant coefficient. The integral of equation (3) can be obtained in closed form when m is half integral. For example, for $m = 2$